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VIII.—*Summary of the Report on the Survey of the Isthmus of Darien.* By LIONEL GISBORNE, Esq., F.R.G.S., &c.

Read June 9, 1857.

[THE Isthmus of Darien was visited in 1851 by Messrs. Gisborne and Forde, who made some short incursions into the country from both coasts; but having been taken prisoners by the native Indians, and escaping from them with difficulty, they were unable to make a complete examination of the country. Sufficient information was, however, elicited, more particularly as regards the advantage of a good harbour on each coast, to warrant an application to the governments of England, France, and America, to form a joint expedition, with the view of making a survey of the interior of the Isthmus of Darien, between the Gulf of St. Miguel on the Pacific, and Caledonia Harbour on the Atlantic. These arrangements were made, and Carthagena was selected, in the first instance, as a place of rendezvous for the Atlantic portion of the expedition; but it was subsequently found advisable to meet at Jamaica.]

THE only native opposition to be feared was on the Atlantic coast, and it was probable that some delay would occur before arrangements could be made to cross the Isthmus from that side. I therefore instructed Mr. Forde to proceed with the whole of the engineering staff to the Gulf of St. Miguel, viâ Navy Bay and Panama, and to commence the surveys of Darien Harbour and Savannah River. Mr. Forde was also desired to call upon the Commanders of the U.S. corvette *Cyane*, and H.B.M. surveying schooner *Scorpion*, ordered to Carthagena to meet the expedition, and request them to arrive at Caledonia Bay simultaneously with the *Espiegle* and *Chimère*, the English and French ships of war whose rendezvous was Jamaica.

Such an arrangement was important to the success of the expedition to secure combined and simultaneous action with the Indians, who, I felt assured, would be awed by a show of force, and gradually weaned from their exclusive policy by being treated in a conciliatory spirit. Independent action on the part of any of the naval commanders was sure to frustrate the object and increase the difficulties.

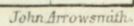
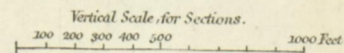
Commander Hollins of the *Cyane*, however, sailed and landed a party under the command of Lieutenant Strain, with orders to cross to the Pacific, five days before the arrival of any other man-of-war. Master Parsons, commanding the *Scorpion*, remained at Carthagena until the date fixed for the rendezvous at Caledonia Bay.

On the 23rd of January the following men-of-war were in Caledonia Bay:—

H.B.M. brig *Espiegle*, Commander Hancock.

H.B.M. schooner *Scorpion*, Master-Commanding Parsons.

1854.



H. I. M. steam-ship *Chimère*, Lieutenant-Commanding Jauréguiberry.

U. S. corvette *Cyane*, Commander Hollins.

The officers specially deputed by their respective Governments to satisfy themselves, by a personal examination of the interior, of the correctness of the surveys undertaken by the Company's engineer, were—Colonel Codazzi, head of topographical department of New Granada; Lieutenant Jauréguiberry of H. I. M. Navy (French); Lieutenant Strain, of U. S. Navy (American); Lieutenant St. John, R. E. (English).

Previous to my arrival in Caledonia Bay on board of the *Espiegle*, Commander Hollins had entered into an arrangement with some of the Indian chiefs that no party from his vessel was to be molested during their investigations in the interior as long as they respected life and property; but the Indians gave him to understand that they would in no way assist the operations of such parties.

The commanders of the *Espiegle* and *Chimère* made similar terms with those Indian Chiefs, and on the 24th of January the following party were landed, carrying 10 days provisions:—

Lieutenant Preston, Mr. Edwards, Assistant-Surgeon Edwards, and 14 men (armed) from *Espiegle*; Lieutenant Jauréguiberry, Lieutenant Oron, and 14 men (armed) from *Chimère*; Colonel Codazzi and 4 men; Lieutenant St. John, R. E.; Dr. Cullen; Mr. Lionel Gisborne and 9 men; forming altogether a party of 50 persons, of whom 36 were armed.

Commander Hancock and Lieutenant Jauréguiberry sent the armed men to afford protection, fearing that the refusal of the Indians to assist in any manner the objects of the surveying expedition might place the exploring party in danger.

The river Caledonia was ascended for two days; on the morning of the third day an American party, under the orders of Lieutenant Fauntleroy, overtook us, and Lieutenant St. John proceeded with them, thinking that they would cross to the Pacific before us. On the third day it was found that the Caledonia river did not pass through a break in the main ridge of the Cordilleras, but that they, on the contrary, formed a continuous high range. My original anticipations on this point were thus disproved.

It then became my duty to explore this main ridge of the Cordilleras, to search for a break through them. With this object the valleys of the Caledonia and Aglasenica rivers, and their tributaries, were carefully examined, and several attempts made to cross the Cordilleras, but the extreme difficulty of moving about a large body of men among steep hills thickly covered with wood and intersected by deep ravines, made it

evident that the Isthmus could not be thus crossed without great risk and danger or suffering from want of provisions. After eleven days' exploring, the whole party (increased to 120 by the addition of 70 New Granadian soldiers and convicts) returned to the ships. The Americans, under the command of Lieutenant Fauntleroy, and accompanied by Lieutenant St. John, returned three days after leaving us on the Caledonian river, without having succeeded in crossing the Cordilleras. Nothing had been heard of Lieutenant Strain, and several parties sent in search of him returned without any tidings.

We heard at this time that Captain Prevost,* of H.M. steam-sloop Virago, had, by orders of his Admiral, formed an expedition to cross the Isthmus from Darien Harbour to Port Escoses; that in complying with these orders, four of the party had been killed by the Indians early in January; and that the rest had only escaped by a forced march towards their ship, being closely followed by two hundred armed Indians.

Robinson, the second chief of the whole tribe of the San Blas Indians, told us of this casualty; he explained that no treaty had been made with those persons, and the Indians, unaware of any friendly incursion into their territory, took them for Spaniards, and killed them in accordance with the law they had enforced for beyond a century: he assured us that no such act would be perpetrated against any one coming from the vessels in the harbour, because a treaty had been made guaranteeing their safety from molestation.

It appeared to be the impression among the Indians who occasionally came on board, that Lieutenant Strain and his party had lost their way, and were starving to death; 18 days had elapsed since they landed, and they had started with only 10 days' provisions.

Experience had proved that moving a body of men sufficient to act as a protecting force and to carry the necessary provisions was attended with great risk and great delay; I therefore determined to use every means to obtain native guides, and cross, if necessary, alone with them. Had all the commanders of the men-of-war acted in concert at the outset, I have no doubt that native guides could have been procured and a better treaty made with the Indians; the independent action of the American commander created difficulties at every step. The Indians, although offering no direct hostility, abandoned their villages at our approach, and during the whole time of our absence in the interior I believe that only two Indians were met with, and they had evidently been surprised in a banana plantation without being aware of our approach.

* See Journal of the Royal Geograph. Soc., vol. xxiv. p. 171.

All these Indians have fire-arms, which have wholly superseded the bow and arrow as an arm for warfare.

After many conferences, it was at last arranged that Robinson, the Indian chief, was to provide guides and accompany Lieutenant St. John and myself, with two men, as far as the head-quarters of Mr. Forde, at the confluence of the Savana and Lara, as fixed in my instructions to him. Commander Hancock and Lieutenant Jauréguiberry acquiesced in this arrangement, and we started on the morning of the 7th of February, carrying five days' provisions.

We ascended the Caledonia river, and crossed the ridge of the Cordilleras between it and the Sucubdi at an elevation of 930 feet above the sea. We descended the Sucubdi river as far as the village of that name, and in consequence of the difficulties of getting canoes, and hearing that eleven days before Lieutenant Strain's party had been seen proceeding towards Asnati, we directed our course N.W., and crossed the valleys of the Asnati and Morti rivers.

At the latter village, the chief, who acted in a most friendly spirit, provided canoes which conveyed us to the Chuquanaque river, and up to the point where "Prevost's track" strikes it. We walked along this track to the Savana, having been five days in crossing. About three miles from the Chuquanaque, we found three of the bodies of the men from the Virago, who had been murdered by the Indians. Their clothes and provisions were untouched, their bones, still forming connected skeletons, clean picked by vultures, presented in their half-clothed state a hideous appearance; the fourth man, it is supposed, was wounded, and, having taken to the bush, was despatched at some distance from his comrades.

On our reaching the Savana, we found provisions and memorandum left by Mr. Forde's party, and descended in the canoes to the confluence of the Savana and Lara, the head-quarters of the Pacific portion of the expedition.

I had expected to find the surveys on this side in an advanced state, but, on the contrary, Mr. Forde was at Panama laid up with rheumatic fever, and the fatal termination to Captain Prevost's expedition had caused such a panic in the villages of Chapigana and Yavisa, that neither men nor canoes could be got on any terms, and the engineers, abandoned even by the sailors of the small cutter which had been chartered at Panama, were unable to forward the surveys.

Lieutenant St. John and I having crossed with safety, and the fact of Robinson being with us, inspired confidence; and by paying exorbitant wages a few men and canoes were procured, and the surveys put in hand.

From the accounts I heard of the low ground found by Captain

Prevost, as far as the Cordilleras, from whence some of his party stated they saw the Atlantic Ocean, I was anxious to verify these statements, although already aware that Captain Prevost, misled by the incorrect published charts of both coasts, had followed a N.N.E. course which strikes the Atlantic much to the north of Caledonia Harbour.

The Sucubdi pass is south of a good direction between Caledonia Harbour and Darien Harbour; "Prevost's track" is north of it; the Pacific flank of the Cordilleras, between these two points, had been sufficiently examined to give a correct idea of the general topographical features of the country. A considerable portion of the Atlantic flank had also been explored. I hoped, by recrossing "Prevost's track," to collect sufficient general information to decide upon the direction, if any detailed surveys and sections should be undertaken from the Atlantic side.

Mr. Armstrong and I left the Savana River, and started with Robinson and two men, on the 17th February; we reached the end of "Prevost's track" in three days, and went a day's journey further in a north-easterly direction without being able to reach the top of the main range of the Cordilleras, or any point from which the Atlantic ocean can be seen; we found that a N.E. course would come out on the Atlantic about Putrigandi, where the Spanish charts denote the presence of swamps, and among Indians, who not being aware of our approach might use violence and frustrate our object. We could not have reached the vessels without canoes, and if they had been refused we must have returned again to the Pacific. One of the party was completely knocked up from fatigue; and Mr. Armstrong and I had to carry nearly the whole of the kit and provisions.

We reluctantly returned to the Savana; I had received a severe scorpion bite which inflamed my arm so as to render it useless; fatigue, and want of sleep from pain, unfitted me to undergo the exposure and hardships of a third expedition to cross. We attempted it however, but failed again from the want of canoes to ascend the Morti river; the Indians from that village having mistaken the day they had promised to return for us, and hearing that we had proceeded along Prevost's route towards the Atlantic, had gone back to their settlement. I then determined to proceed to Panama; the small ten ton cutter anchored at the mouth of the river Lara was the only available boat. Lieutenant St. John had returned to Panama in the schooner which had come down with provisions, three days after Mr. Armstrong and I started to recross by Prevost's track, stating that it was his intention to proceed to England.

After beating about 5 days against contrary winds, we were driven back to the bay of St. Miguel; a large barque had brought

some Granadian soldiers and convicts to assist in the objects of the expedition. I chartered her to return to Panama, and just as we were setting sail, H.M. steam sloop *Virago*, Commander Marshall, steamed into Darien harbour.

Rear-Admiral David Price had sent her, in accordance with the instructions forwarded by the Admiralty to have an English vessel of war stationed in Darien harbour during the progress of surveys.*

Commander Marshall and his officers received us on board with the cordiality of brother explorers, and my sufferings from the effects of the scorpion bite were relieved by medical treatment. I had used every endeavour to induce the Indians at Morti to give me canoes to descend the river Chuquanaque to search for Lieutenant Strain, who I felt certain was lost along its banks. Mr. Bennett had by my instructions arranged to proceed on this service, but when the time came, the Indians from Morti, who returned according to their promise to the Chuquanaque end of Prevost's track, refused to descend the Chuquanaque, stating that the country belonged to New Granada, with whom they were not on friendly terms. The authorities at Chapigana and Yavisa would in no way countenance an expedition to ascend the Chuquanaque, nor could men or canoes be engaged for this service on any terms.

The arrival of the *Virago* renewed my hopes of finding Strain.

Commander Marshall had received instructions to seek redress for the loss of four men of the *Virago* in last January, and to assist and protect the surveys.

These duties were incompatible, and at his desire I wrote a letter urging the abandonment of "seeking redress," and substituting "the search for Lieutenant Strain and his party."

Commander Marshall acceded to my request, and after landing Mr. Armstrong, Mr. Bond, and myself at Panama, a boating expedition was formed with this object, commanded by Lieutenant Forsyth, who volunteered for the service, and accompanied by Mr. Bennett.

They left the *Virago*, in one of the paddle-box boats, on the 17th of March shortly after midnight, and reached the confluence of the Chuquanaque and Tuyra the same day at sunset, and the village of Yavisa about 10 P.M. With considerable difficulty, 6 canoes and 11 natives were hired; about 17 miles above Yavisa, the ship's boat had to be left in charge of the gunner and 6 men, shoal water preventing its going any higher up.

On the 23rd March, the dead body of Señor Polanco was found

* Captain Prevost's expedition was formed previous to the receipt of these instructions, and in ignorance of any expedition leaving England.

lying on the grave of Señor Castello; they had been sent out by the Granadian Government to assist in the objects of the surveying expedition, and had volunteered to accompany Lieutenant Strain's party. A good deal of time was lost in dragging the canoes over shoals and avoiding trees. On the evening of the 23rd March, the missing party was found in a most deplorable state of destitution. Notwithstanding Dr. Ross's (of the *Virago*) assiduous care, one of them died before they returned to the vessel (29th March), making the sixth victim to starvation. For 50 days had these unfortunate men subsisted wholly upon small palm nuts, which had worn all the enamel off their teeth. Considering the nature of the country and the awful privations they suffered, too much credit cannot be given to Lieutenant Strain for the extraordinary energy, endurance, and perseverance he has displayed. It is much to be regretted, that the splendid qualities he has shown as an explorer were not made available to collect information important to scientific and commercial interests.

Mr. Bennett has made a track chart both in ascending and descending the Chuquanaque. It agrees most remarkably with a map given to me by Colonel Codazzi, out of the archives of Bogota, made in 1787, by a Spanish officer, who ascended it as far as the Isola de la Paz at the mouth of the Sucubdi. The Spaniards had at one time an encampment of 400 soldiers on this island, which communicated by a road (a foot-path) with Fuerte del Principe on the Savana; they were however obliged to abandon this post in consequence of the opposition of the Indians and the overflows of the river in the wet season.

They made several attempts to cross from Isola de la Paz to Fort Carolina in Caledonia Harbour, but were driven back by the Indians. Lieutenant Milla (a Spaniard) crossed from Fort Carolina to Fuerte del Principe in 1787, accompanied by an Indian chief named Ruchuchie; the Buccaneers in 1680 went from Caledonia Harbour to the Chuquanaque and descended it to Darien Harbour, destroying the town of "Santa Maria," where the Spaniards were supposed to have a depôt of gold. I believe these to be the only authentic accounts of the Isthmus of Darien having been crossed.

In approaching the Pacific coast from the seaward, a succession of three anchorages is offered to the mariner. 1st, The Bay of St. Miguel; which may be classed as an open roadstead, better sheltered, and with better anchorage than either Navy Bay or the bay of Panama; 2ndly, St. Miguel harbour, well sheltered by a row of islands of considerable extent, accessible at all times and with good holding ground; 3rdly, Darien harbour, a land-locked estuary approachable by two deep entrances, perfectly sheltered, of great extent, and with deep water close in shore.

On the Atlantic there is only a tide of from 11 to 17 inches; on the Pacific spring tides rise 24 feet, neap tides 18 feet. With such a difference in the tides of the two oceans it is impossible, without long-continued and careful observations, connected by a perfect set of levels, to state with accuracy what is the *exact* comparative mean level of the two oceans; but the levels and observations made by Colonel Totten, the engineer to the Panama Railway Company, and those made by Colonel Childs at Nicaragua, render it, I consider, no more doubtful that the mean level of the two oceans, where the tides are unaffected by local circumstances, such as an indented line of coast, the presence of shoals, &c., may be said to be practically the same. The position of the rivers Savana and Lara have been fixed by a triangulated survey, which nearly agrees with the course originally laid down in the maps appended to my former Report. The character of the country between the Savana and the Chuquaque is similar to that described in that Report. Two flat plains are separated by a low range of hills. Mr. Forde and I penetrated in the year 1852 across the water-shed of the Savana, and, finding traces of Indians, returned again for fear of being taken prisoners a second time. The loss of Commander Prevost's men within a few miles of this place, and the fact that 200 armed Indians having followed him and burnt the ranchoes (sheds built as night quarters) as far as the water-shed of the Savana, proves that our fears were well founded and our retreat judicious. I have no doubt that had we persevered in exploring the river which we supposed to be the Caledonia we should have known our error, but never returned to communicate the fact.

The Chuquaque has its source considerably to the north of where Spanish maps had placed it: the general impression has been that it is a precipitous river with numerous rocky falls, whereas it is only 115 feet above mid-tide at the point where Prevost's track strikes it, being an average fall of 11 inches per mile throughout its whole course. It receives a number of tributaries, nearly all flowing from the Cordilleras, the water-shed between it and the Savana being narrow and devoid of rivers.

The surveys on the Pacific side were now in a forward state, but the best portion of the season had been lost, and but little advance made in the surveys on the Atlantic side, where the chief difficulties exist.

I returned to Caledonia Harbour on the 22nd March: nothing had been heard of me for nearly six weeks, and I believe that every one, except Captain Hancock, had given me up as lost. Lieutenant St. John had returned to England; Colonel Codazzi and his troops and convicts had returned to Carthagena; the Chimère was at Carthagena to meet the French admiral; the

Scorpion had completed the survey of Caledonia Harbour; the *Espiegle* was at anchor, and her commander and officers welcomed us on board in the spirit which secures friendship.

Arrangements were immediately made to go again into the interior with all the available staff (Messrs. Armstrong, Devenish, and Bond), and a survey and section was put in hand along the valleys of the Aglasenica and Asnati rivers. The outline of the Cordillera ridge, as seen from the top of Oro Island,* appears to dip about the head of the Aglasenica; but the broken character of the country, thickly covered with wood, makes it difficult to distinguish the main ridge from the subsidiary. The lowest point between the sources of the Aglasenica and Asnati rivers is 1013 feet; the Atlantic flank is very precipitous, but the fall towards the Chuquanaque more gradual.

We walked along the Cordilleras' top for several miles s. of the Aglasenica Pass, and I feel assured that no gorge exists between that pass and that at Sucubdi.

I made arrangements to cross again to the Chuquanaque from the village of Sassardi, along the valley of the river Morti. Lieutenant Preston (1st of the *Espiegle*) again gallantly volunteered to accompany me; we were to go alone, with two Indian guides promised to us by Denis, one of the chiefs of Sassardi, and the principal trader along the coast; but on arriving at Sassardi we found that the first chief of the settlement had collected forty or fifty of his men to oppose our entry. An angry discussion arose, during which the Indians showed such hostility that it was evident that force alone could obtain a passage to Morti. Hitherto our relations with these Indians had been friendly, and they had acted with good faith; I felt sure that Strain and his party had not been attacked by them, although they may have suffered from their want of co-operation; to enter into hostilities now was to assure the death of the whole of this missing party, and risk more lives for an object which offered no particular inducements.

The Indians say that the Sassardi Pass is higher than the Sucubdi one, and that the upper portion of the Morti River is more rocky and difficult to walk than that of the Sucubdi. I have no reason to believe that such is not the case: the Cordilleras n. of Sassardi, where I had been, in continuing out Prevost's track towards the Atlantic, are certainly a high unbroken range; the valleys of the Sucubdi and Asnati are elevated and not very precipitous for the first four or five miles from their source. The Morti River is not navigable for canoes beyond the village of that name, and the Cordilleras opposite Sassardi appear from the

* A clearing was here made to obtain a view.

seaward an unbroken range, with a number of spurs descending down to the coast.

The rainy season was commencing, and the rivers were sensibly affected by the showers, which began to fall with regularity two hours before daylight. When the rivers are swollen it is impossible to walk in the interior, so that supposing the Sassardi Pass to be the lowest, which I have every reason to believe it is not, no surveys could be undertaken this season in that direction without great risk to the surveyors.

For these reasons we reluctantly abandoned the examination of this portion of the isthmus.

On the completion of the surveys and sections along the valleys of the Aglasenica and Asnati rivers, we returned to Carthagena on the 9th of April, and bade farewell to our friends on board the *Espiegle*, *Chimère*, and *Scorpion*, through whose assistance and co-operation we had succeeded in examining without a single casualty a country where hitherto all explorers had failed from the determined opposition of the natives, and which had more than once resulted in a sacrifice of life.

Robinson and Denis (two Indian chiefs) told me that on Mr. Forde and I being taken prisoners in 1852 our death was determined on, and it was only the accidental absence of the chief of Caledonia on a fishing excursion that caused a delay, and gave time to our friend "Bill," the Indian who on that occasion took our part, to persuade them to expel us from the coast.

A set of meteorological observations have been registered on each coast almost hourly during the whole time of my stay. They present some very interesting information relative to the regularity of the atmospheric tide. The hourly barometric observations, taken with standard instruments previously compared with the standard at Greenwich Observatory, have enabled me to fix a number of heights in the interior by means of the mountain barometer with almost the same exactness that a set of simultaneous observations give. A great many of these barometric heights have been checked by actual levels, and generally proved correct within 10 feet. From my experience of the use of the mountain barometer on the Spanish Main, I believe that a barometric section carefully made with good instruments can be depended upon within 10 feet.

The extreme difficulty of levelling in a country covered with a dense forest and intersected by deep ravines and precipitous spurs makes the use of the mountain barometer most valuable for determining the general elevations. It will be seen by reference to the thermometric and hygrometric registries that the temperature of the air does not vary much from night to day, and that at no time

was the heat very great; the constant breeze prevents that sultry feeling experienced in many other places in the tropics.

The absence of swamps, the cool breezes, and the equable temperature are the principal causes which make both coasts of this isthmus as well as that of the interior so healthy. The report from the medical officer attached to the expedition speaks most highly of the salubrity of the isthmus.

There have been altogether in this surveying expedition 900 persons subjected to climatic influences, some along the coast, some in the interior; and I believe that I am correct in stating that not a single case of illness occurred during the whole period of our stay, and the only casualties were a scorpion bite I received, and an accident to a marine from the *Espiegle*, who was confined to his hammock for a few days from falling upon the stump of a tree.

Considering the exposure and hardships the men were subjected to in the interior, but which only seemed to stimulate the spirit of volunteering, it is surprising that no fevers or festering wounds resulted.

Commander Prevost's experience on the Pacific side * has been very favourable to the salubrity of the isthmus, and he records the same remarkable absence of all ailments among men exposed to similar hardships and living upon a short allowance of salt provisions.

Hitherto the only reliable published charts of both coasts of Darien were those made by the Spaniards nearly a century since. These charts are incorrect. Captain Prevost, in laying down the shortest route from the Savana to Port Escoces, adopted a N.N.E. course; whereas the true bearing of Port Escoces from the point of the Savana, where he left it, is E. 17° N.; a N.N.E. course strikes the Atlantic coast 20 miles N. of Escoces. Captain Prevost, in his Report, states how completely the incorrect published charts and maps misled him.

The reason of this discrepancy is that the coast line at St. Miguel Bay is placed 8 miles wrong in longitude, and nearly 3 miles wrong in latitude. Caledonia Harbour is 8 miles wrong in longitude. When it is considered that the total distance across from the point the tide reaches in the Lara to the Atlantic coast is, according to these charts, only 21 miles, it is evident that any conclusions drawn from them as to the relative positions of points in the interior must be wholly fallacious. Of the interior itself, the most authentic map which I have had access to is that furnished by Dr. Cullen to Sir Charles Fox. My former imperfect examination of a portion of the isthmus proved this map to be untrust-

* See vol. xxiv. of the Journal of the Royal Geograph. Soc., p. 249.

worthy ; the more correct and detailed examination now made has proved that the published charts are likewise untrustworthy. Lieutenant Strain, possessing only similar incorrect information, supposed himself to be on the Savana when he was at the head of the Sucubdi, and on reaching the Chuquanaque hourly expected to see the Pacific tide ; the distance he had walked, supposing even it was not over-estimated, an error which can hardly be avoided, should, by the information derived from the charts, have made his position on the Chuquanaque very near to Darien Harbour. The Savana and Chuquanaque both run nearly N. and S. ; the Chuquanaque was not known to extend so far N. ; Lieutenant Strain, therefore, took it most naturally for the Savana, and followed it down.

The incorrectness of the position of Caledonia Harbour was determined a very few days after our arrival on the coast. Two days exploring up the Caledonia River showed that no gorge exists through the main ridge of the Cordilleras in that direction. Thus the main facts upon which the design for an uninterrupted ship-navigation was based were disproved at the outset.

The map represents the general topographical features of the country. The harbour of Caledonia has been most carefully surveyed, and in great detail, by Master Parsons, commanding H. M. schooner *Scorpion*. Nothing can be more satisfactory than the result of this survey. Two good entrances into a perfectly sheltered basin with deep water and good anchorage, offer rare advantages when situated in a healthy locality, commanding beautiful scenery and possessing an unlimited amount of excellent fresh water.

Darien Harbour can be best judged of by an examination of the map. It cannot be excelled for shelter, extent, good anchorage and beautiful scenery. The survey of this harbour has been made by Master Inskip of the *Virago*, who most kindly executed this work during the absence of the boating expedition up the Chuquanaque. The coast survey was made by Captain Kellet, R. N.

The Morti, Asnati, and Sucubdi rivers are navigable for canoes up to the villages of the same names ; above these points, they assume the character of mountain torrents, flowing sometimes through rocky gorges, but presenting generally the character of reaches terminated by rapids ; in the dry season, from December to May, they have wide shallow beds, with here and there deep pools, but in the wet seasons they form foaming torrents, occupying the whole valley, and carrying down rocks and trees.

The Cordilleras are an unbroken range, varying from 900 to 1600 feet in height, from which branch off a number of subsidiary ranges, ending abruptly where broken through by river valleys,

and presenting, particularly on the Atlantic flank, the character of narrow gorges with precipitous sides. The Caledonia, Aglasenica, and Sassardi rivers flow into the harbours of Caledonia and Sassardi; the former and latter are navigable for canoes up to the villages named after them situated at the very foot of the Cordilleras which rise abruptly above them.

The whole country to the top of the highest summits is covered with a dense forest, and I cannot perhaps exemplify better the difficulty of cutting one's way through it, than in referring to the slow progress made by Captain Prevost, over a flat country not nearly so thickly covered with underwood as are the flanks of the Cordilleras. Captain Prevost's arrangements for carrying out his object were most admirable, and the energy and perseverance displayed by his whole party are a guarantee that no time was lost in pushing on as far as circumstances would admit of. Notwithstanding this he was 12 days cutting a path 19 miles in length, the party consisting of not less than 20 men. Place the same energy and perseverance, actuated by a similar object, among deep ravines and innumerable spurs with almost precipitous sides, the whole densely wooded, and the progress made would be considerably less; the difficulty of carrying provisions is also greatly increased as well as the chance of losing the way, or determining any position relative to the coast.

At first we used to toil up the top of the highest and steepest spurs, hoping to get a view of the general features of the country; experience soon proved that in nine cases out of ten, the tops of the hills offered no better views than the bottom of the valleys. It must be remembered that these forests do not only consist of a number of tall stems capped with foliage, but that every branch and every stem is interlaced with creepers, that hang in festoons down to the thick underwood which almost everywhere covers the ground. It is a wall of foliage of the tropical type. During the whole time I was on the Isthmus, I did not get half a dozen glimpses at recognisable objects which were more than a few yards distant. The general direction of a valley can sometimes be traced for a considerable way, but the fact of the view being guided by a line of trees offering an uniform sameness, broken by no salient point, deceives the judgment in estimating the distance. It is almost impossible not to over-estimate distance in this country, when judged of either by the eye or from walking.* There is nothing *relative* to fix one's judgment upon when the eye meets everywhere a mass of foliage which is so dense, that whether it is a mile off or five or six miles off, nothing but the whole mass is distinguishable. The peculiar bright or hazy state of the atmosphere

* See vol. xxiv. of the Journal of the Royal Geograph. Soc.

(for although contradictory, only both words can express the halo caused by a brilliant tropical sunshine upon foliage) adds to the deception, particularly when light clouds are floating about the tops of the higher hills, as is generally the case about the Cordilleras.

There is no doubt that, on our former visit to the Isthmus, Mr. Forde and I were greatly deceived both as to the distance walked and as to the distance seen.

We crossed two ranges of hills opposite to Port Escoces, having had no opportunity of obtaining any view of the country such as was afforded in this visit from the top of "Isla del Oro." The river Caledonia, about $2\frac{1}{2}$ miles higher up than where we ascended the mound and got a view to the s.w., turns suddenly to the s., dividing into two branches, giving this place the appearance of a gap in the hills. The quantity of water flowing in the Caledonia, showed that the source could not be less than seven or eight miles distant, and as the only flat country is to the s.w. it was not unreasonable to suppose that the valley continued in that direction. The late investigations have proved both to Captain Prevost and to myself the impossibility, in such a country, to judge of distance, or to found opinions upon partial views without long experience earned by toil and danger. Our first visit was made under peculiar circumstances, attended by great personal risk, and without any previous information, to correct impressions or to lead the judgment. When the error is pointed out, it is easy for others to express surprise and show how it could have been avoided, but the fact should be judged by what was then known, not by what has been since elicited. Under the circumstances we arrived at and left Port Escoces it was not to be expected that latitudes and longitudes could be correctly fixed; we then succeeded in penetrating a certain distance into the interior from both sides of the Isthmus, bringing home some correct and some incorrect information; this time surveys have been successfully made and the country well explored. Until Mr. Forde and I drove in the small end of the wedge, the Indians had kept their country shut out from all inquiry, and had not we been in a position to obtain the assistance and co-operation of influential governments, this country would have still been a blank in the annals of geography, and public opinion remained restless and dissatisfied as to the question of a great Ship Navigation in this locality.

The map and sections* speak for themselves as to the impossibility of carrying out an Inter-oceanic Navigation without locks—which shall at all times pass the largest vessels afloat. The harbours are magnificent, the climate healthy, the country fertile

* See vol. xxiv. of the Journal of the Royal Geograph. Soc.

and covered with valuable timber; in fact, everything exists for anything but a ship-navigation, suited to the commerce of the two hemispheres. The commerce of the world demands a large inter-oceanic navigation, and it is not because the Isthmus of Darien cannot be made available for this purpose, that the question itself is to fail, and that commerce must rest satisfied with inter-oceanic roads and railroads.

The public will not be content until the whole of the country lying between the Rio Atrato in New Granada and the Gulf of Campeche of Mexico, has been searched for the best place to make the communication which is to divide a continent.

Wherever the favoured spot is, two elements must exist: good harbours (or the means of making them), and a short distance. This limits the inquiry to a very few places, and those can be reduced to two or three by a cursory examination.

Two surveying vessels on each coast could in a few months examine the unsurveyed portions of Central America sufficiently to decide where good harbours or facilities for making them exist.

It is not probable, that many such places will be found opposite each other; where such is the case, a general examination of the interior would soon eliminate the impossibles, leaving perhaps two or three places where a more careful and detailed examination may be necessary.

It must be remembered that the Isthmus of Darien is the only portion of this country which has been heretofore wholly unknown, or where the natives oppose the entry of explorers, so that the difficulty of examining any other part of the interior between the Atrato and the Gulf of Campeche would not be so great as that experienced in Darien.

Emigration to California showed the necessity of something better than the old Spanish mule track from Chagres to Panama. The Panama railway when first brought under the notice of capitalists was received coldly, and doubts were thrown upon its commercial advantages. Three American firms had for years the sole management of this work, supplying all the capital. There are now two rival schemes competing for this local traffic, local to the continent of America. At Nicaragua there is already a transit; the one at Tuantepique threatens to become so.

If the traffic of one state actually supports two routes, and might support half a dozen, surely the commerce of two hemispheres can afford to secure one for itself; or if some hesitate to arrive at such a conclusion without knowing before-hand what this desirable object would cost, they must admit that the object is at least worth the trifling expenditure required to determine where the greatest facilities exist to form a transit route, whether canal, railway, or road.

Nor can the search for this locality be left wholly to private enterprise. Much depends upon the results of coast surveys, which are but a trifling expense to governments having surveying vessels ready equipped, and a great deal also depends upon the spirit, in which the Powers who rule the countries, grant concessions for the use of their territory: besides, a great work which will affect the commerce of almost every maritime nation, must be conducted with the support and under the guidance of the first Maritime Powers, and it is therefore their interest to assist in the settlement of the question.

IX.—*On the Causes of the Mild Winter-Temperature of the British Islands.* By THOMAS HOPKINS, Esq., M.B.M.S., Vice-President of the Manchester Literary and Philosophical Society, &c.

Read June 22.

MANY well-informed persons believe that the temperature of oceanic currents materially affects, and to a considerable extent determines, the climates of countries near to which they flow; and this belief probably rests on the supposed influence of the warm Mexican Gulf-stream on the climate of the north-western portion of Europe. Such an opinion is to be found in the works of eminent men, advanced in a way which shows that the writers believed it to be generally entertained; and, without producing evidence, they assumed it to be well founded. The president of the British Association, in his opening speech at Hull, distinctly said that the comparatively mild winter-temperature of this country was due to the warming influence of the Gulf-stream; and he ventured a speculation as to the probable effect of an opening being made by nature in Central America, which should allow the tropical ocean current that now runs through the Caribbean Sea into the Gulf of Mexico to pass farther west, and enter the Pacific ocean. Should such a change occur, he represented that this country would be very much colder than it is, and that its winters would become as severe as those of the opposite coast of the Atlantic.

Considering the vague notions that have been entertained respecting meteorological influences on climate, it is not very surprising that such an effect should be attributed to the great warm current which undoubtedly flows from the northern tropic into the Atlantic. The temperature of the part of the ocean where the stream enters it is high for the latitude, and is evidently rendered so along a certain belt near the American coast, by the